

# Claims

- [c1] 1. A downhole drilling system, the system comprising:  
a drill string;  
a transmission line integrated into the drill string; and  
a plurality of network nodes installed at selected intervals along the drill string, wherein the plurality of network nodes are adapted to communicate with one another, through the transmission line, using burst modulation techniques.
- [c2] 2. The system of claim 1, wherein each of the plurality of network nodes further comprises at least one burst modem to implement the burst modulation techniques.
- [c3] 3. The system of claim 2, wherein the plurality of network nodes are configured to communicate with one another by transmitting data packets therebetween.
- [c4] 4. The system of claim 3, wherein the at least one burst modem further comprises an automatic gain control mechanism to automatically adjust the gain of data packets received thereby.
- [c5] 5. The system of claim 4, wherein each of the data packets further comprises a preamble.

- [c6] 6. The system of claim 5, wherein the preamble further comprises an unmodulated carrier portion to enable the at least one burst modem to estimate the carrier frequency of the data packet.
- [c7] 7. The system of claim 5, wherein the preamble further comprises a timing sequence portion to enable the at least one burst modem to estimate the timing of symbols in the data packet.
- [c8] 8. The system of claim 5, wherein the preamble further comprises a unique code to enable the at least one burst modem to detect a data packet transmitted over the transmission line.
- [c9] 9. The system of claim 1, wherein the burst modulation techniques are selected from the group consisting of burst quadrature phase shift keying, burst quadrature amplitude modulation, burst amplitude shift keying, burst phase shift keying, burst on-off keying, burst pulse code modulation, burst frequency shift keying, burst pulse amplitude modulation, burst pulse position modulation, burst pulse duration modulation, burst phase modulation, burst pulse duration modulation, burst pulse width modulation, and combinations thereof.
- [c10] 10. The system of claim 1, wherein the plurality of net-

work nodes are configured to interface to at least one of downhole tools and sensors.

[c11] 11. A downhole drilling system, the system comprising:  
a drill string;  
a transmission line integrated into the drill string; and  
a plurality of network nodes installed at selected intervals along the drill string, wherein:  
the plurality of network nodes are adapted to communicate with one another through the transmission line; and  
the plurality of network nodes further comprise burst modems, wherein the plurality of network nodes are configured to communicate with one another using the burst modems.

[c12] 12. The system of claim 11, wherein the plurality of network nodes are configured to communicate with one another by transmitting data packets therebetween.

[c13] 13. The system of claim 12, wherein the burst modems further comprise automatic gain control mechanisms to automatically adjust the gain of data packets received thereby.

[c14] 14. The system of claim 13, wherein each of the data packets further comprises a preamble.

[c15] 15. The system of claim 14, wherein the preamble fur-

ther comprises an unmodulated carrier portion to enable the burst modems to estimate the carrier frequency of the data packet.

[c16] 16. The system of claim 14, wherein the preamble further comprises a timing sequence portion to enable the burst modems to estimate the timing of symbols in the data packet.

[c17] 17. The system of claim 14, wherein the preamble further comprises a unique code to enable the burst modems to detect data packets transmitted over the transmission line.

[c18] 18. The system of claim 11, wherein the burst modems use a modulation technique selected from the group consisting of burst quadrature phase shift keying, burst quadrature amplitude modulation, burst amplitude shift keying, burst phase shift keying, burst on-off keying, burst pulse code modulation, burst frequency shift keying, burst pulse amplitude modulation, burst pulse position modulation, burst pulse duration modulation, burst phase modulation, burst pulse duration modulation, burst pulse width modulation, and combinations thereof.

[c19] 19. The system of claim 11, wherein the plurality of network nodes are configured to interface to at least one of

downhole tools and sensors.

- [c20] 20. A downhole drilling communications network, the network comprising:
- a top hole node comprising a first burst modem;
  - a bottom hole node comprising a second burst modem;
  - and
  - an intermediate node located between the top hole node and the bottom hole node, wherein the intermediate node further comprises a third burst modem configured to relay data between the first burst modem and the second burst modem.